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DISPERSAL IN SPRUCE GROUSE

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ABSTRACT: Dispersal, defined as the movement of juveniles from their place of birth to their first potential breeding area is frequently considered to be a single movement in behavioural research. However, studies on spruce grouse (*Dendragapus canadensis*) in southwestern Alberta have shown that dispersal movements may be complex, possibly reflecting a variety of behavioural and environmental factors. Although dispersal in spruce grouse can apparently be divided into mojor fall and spring phases, movements during the summer and winter may also affect the overall dispersal distance. Because of the complexity of proximal causes potentially affecting dispersal, examination of dispersal as one single movement may be inaccurate.

Dispersal is a commonly studied aspect of behavioural and population ecology. Previous researchers have frequently defined dispersal as the movement of a individual from its place of birth or hatch to its place of breeding or attempted breeding. However, in looking at dispersal as one single movement, researchers often consider the proximal and/or evolutionary causes of dispersal in an over-simplistic way. For example, a common analysis might look at the effect of population density on dispersal distance. However, by doing that they often assume that other factors are not of conflicting importance. The objective of this paper is to show that dispersal, atleast in spruce grouse, consists of a complexity of smaller movements with a corresponding variety of potential causes.

This research was done at the R. B. Miller Biological Station in southwestern Alberta. I worked there from 1982-1984 as a continuation to a long-term project begun in 1965. The

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habitat on the main study area was dominated by lodgepole pine. Spruce grouse were also found in scattered areas of white spruce. Essentially all spruce grouse encountered were captured and banded with colored bands. This male spruce grouse is an example. In addition, radios were frequently harnessed to birds of all ages and sexes. This female spruce grouse has a radio on her back with the antenna ponting backward. Radios did not appear to have any adverse affect on their behaviour.

This is what the results look like for total dispersal distances in spruce grouse. The distance of movement is shown on the horizontal axes and the number of birds on the vertical axes. These data indicate that females move further than males. That, of course is not a surprise, since females of most bird species move further than males. This type of information is important when considering the ultimate consequences of dispersal. Hovewer, it is not very useful information for analysing proximal causes for individual movements.

This is why. Dispersal in spruce grouse tends to be divided into major fall and spring phases. The fall phase includes movement between the nest site or brood range and the relatively localized winter range. The spring phase includes movement between the winter and summer range. Each phase can be a variety of directions and distances. The spring phase of dispersal tends to be repeated by adults as a yearly migration. In addition, movements can occur, to a more limited extent, near the hatch site, the winter range, and the summer range. Since the overall dispersal distance is measured between the hatch site and the summer range, any of these smaller movements can affect the overall dispersal distance. During the rest of this talk, I will present some of my hypothesis for various proximal causes of these movements.

The hatch site or brood range in spruce grouse is often not an accurate representation of their dispersal starting point. In one case a female spruce grouse nested approximately 2 km away from the male she apparently bred with. The genetic implications would be that her chicks had already effectively dispersed 2 km before being hatched. Additionally, broods move quite rapidly over a large area and those movements may affect their dispersal distance. A typical brood may have a home range of over 50 ha. As if that is not complicated enough, the spring

territoriality of female spruce grouse tends to break down during the brood season. As a result, broods frequently concentrate on good brood range.

When does the brood period end and the fall phase of dispersal begin? It is very difficult to tell, but it is certain that the date of brood break-up is important. The later the brood break-up is, the further from the nest site the brood will likely be. Any movement away from the nest site will tend to be additive toward their total dispersal distance.

These are the fall dispersal distances for juvenile spruce grouse. In other words, this is the distance from the brood range to the winter range. This figure includes both radio-tracked and non-radio tracked birds. One thing these data indicate again is that radio-tracked females move farther more frequently than males. Similarly, the lack of data on non-radioed females suggests that females have moved farther and are therefore, more difficult to find. When I examined the data further, I found that all 13 juveniles that moved more than 3 km had brood hens that migrated long distances in the fall. Ten of these juveniles were observed actually moving with their migrating mother. The contingent of juveniles that moved short distances generally had non-migratory mothers. This possibility was supported by the large amount of overlap between the timing of brood break-up and the timing of brood hen migration. In other words some juveniles leave the brood after moving with their brood hen on her migratory movement. One possible reason for juvenile females moving further than males is that they have a median date of brood break-up 10 days later than males, and therefore an increased probability of moving with their mother on her migration.

Examination of winter movements may also help explain why juveniles move in the fall. 85% of all birds are found on only 15% of the area in the winter. This figure shows the location of these wintering areas in relation to the rest of the study area. Movement to wintering areas may provide an additional explanation for the fall movements of juveniles. In addition, some birds are apparently spaced out in the winter whereas others are not. The movements associated with winter spacing may be an important polymorphic trait affecting some birds, but not others.

The birds that are spatially separated in the winter also seem to be the birds that move very little in the spring. The other, more social birds, tend to move more substancial distances. Both migratory and spring dispersal movements are shown here for comparison. Once again, females move significantly further than males.

This figure shows straight-line paths of female movement. When I compared birds that move short and long distances, I found significant differences. As I just mentioned, short distance dispersers appeared to be more spatially separated during the winter. They were also significantly more variable in behaviours associated with their spring movements. By looking at 20 years of lineage data on spruce grouse, I was able to find some evidence suggesting heritability of spring dispersal characteristics. Based on these differences, which I won't examine more closely here, spring movements appear to be influenced by innate polymorphic factors. In other words, there appears to be a genetic influence to the overall distance of movement during spring.

During the summer and late spring, other factors such as population density and the location of potential breeding partners and areas, seem to be more important. Although these movements can be substantial, they are generally much shorter than typical innate spring movements. These types of movements may be more affected by intraspecific aggression.

In summary, it would take me 5 hours to show all the data I have on all the ideas I've talked about. However even if you ignored all these hypotheses, the result would still be that dispersal in spruce grouse is complex. Hense when you look at the total dispersal distances, you have to consider that they are probably composites of several different movements with potentially different causes.

This complexity is not unique to spruce grouse. Most species of birds move between winter and summer ranges. However, very rairly do researchers consider that dispersal may consist of separate smaller movements, each differing in both time and cause. Before dispersal can be more thoroughly understood, it must be considered in the light of its obvious complexity.

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